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BACKGROUNDER

Clean water regulation for the metal mining sector

Ontario has proposed a draft regulation to protect the environment from effluent discharges from the metal mining industry.

The proposed clean water regulation establishes limits for pollutants discharged by metal mines and refineries. It is designed to reduce significantly the amount of toxic and conventional pollutants entering Ontario's waterways from this industry.

The metal mining sector is one of the largest dischargers of wastewater in Ontario. Monitoring results indicate that this sector discharges about 695,000 cubic metres (150,000,000 gallons) of wastewater per day. That's equivalent to about 700 olympic-size swimming pools.

Reducing the quantity of toxic chemicals discharged in effluents from the mining sector will curtail the risks posed to the environment, human health, fish and wildlife. The clean water regulation limits also will help the ministry implement initiatives such as the Lake Superior Binational program, the Remedial Action Plan program and the Lake Ontario Toxic Management program.

The metal mining sector at a glance

The metal mining sector is one of the province's major industries, employing about 17,500 people. Most metal mining operations are located in northern Ontario but two are located in southern Ontario (Port Hope and Port Colborne)

There are 32 sites regulated by the metal mining clean water regulation. The 32 mining sites and refineries are divided into four sub-sectors:

gold	- 13 companies
iron	- 1 site
uranium	- 2 sites
base metals	- 16 sites (nickel, lead, copper and zinc)

The regulation will apply to all operating metal mines in Ontario.

Goal of MISA

The clean water regulation for the metal mining sector was developed under the Municipal/Industrial Strategy for Abatement (MISA) program.

The goal of MISA is the virtual elimination of persistent toxic substances from wastewater discharged into Ontario's waterways. MISA was introduced in 1986 to identify and reduce the pollutants discharged from industrial and municipal sources into Ontario's rivers and lakes.

The first phase of the program -- monitoring the effluents from 300 major industrial direct dischargers -- was completed in August 1991. In September 1991, the Ministry of Environment and Energy, then Ministry of the Environment, published the Issue Resolution Final Report which defined concepts and principles that were crucial for the implementation of the clean water regulations. At the same time, the ministry introduced a new direction which included:

- the identification of pollution prevention as the preferred approach to achieve the virtual elimination of persistent toxic substances
- the establishment of effluent limits for a list of sector-specific parameters
- the establishment of a ban or phase-out list for specific persistent toxic substances
- the requirement that final effluents cannot kill fish or water fleas as measured by standardized tests

Based on these principles and on monitoring data, the ministry is developing regulations for industrial sector dischargers to reduce the amount of toxic and conventional contaminants they discharged.

Reduction of loadings

Implementation of the clean water regulation from Ontario's mines and metal mining refineries will reduce the discharges of copper, nickel, zinc, cyanide and arsenic by 40 per cent.

Conventional pollutants (such as total suspended solids) will be reduced by 23 per cent. These reductions are in line with the goals of the MISA program.

Sources of contaminated mine wastewater

The MISA monitoring program revealed that the metal mining sector discharges approximately 695,000 cubic metres of wastewater per day but this represents just a fraction of the water used. Mining operations use large quantities of water. More than 75 per cent of the water used in mining operations is obtained by recycling wastewater.

Wastewater from mining operations originates from two sources: the mine and associated facilities, and the tailings disposal area and its associated facilities.

In the mine, water is used for drilling, cooling, dust suppression and sanitation. Outside the mine, water is used to process minerals and to convey tailings to disposal areas or back to the mine for use as backfill.

The water used in the mine becomes contaminated when it comes in contact with minerals in the ore, machinery lubricants and other chemicals. Suspended solids and contaminants in water in tailings disposal areas reflect the mineral content of rocks and slurry -- a watery mixture of insoluble matter -- being disposed of, as well as the type of milling processes being used.

Water also percolates into a mine from the surface. Water is pumped out to prevent flooding of a mine and to permit mining operations to continue.

What are the major environmental concerns

Some metal mining wastewaters contain metals such as copper, lead, nickel and zinc, and other substances such as cyanide and arsenic which, in the environment, may be toxic and persistent. The wastewaters also contain conventional pollutants such as suspended solids.

The discharge of these substances can lead to the impairment of lakes, rivers and streams that ultimately drain into the Great Lakes and James Bay.

Heavy metals contained in wastewater discharged by mines or refineries can accumulate in sediments on the bottom of a body of water and can be harmful to human health, fish, aquatic plants and other aquatic life.

Copper, nickel and zinc are the metals most commonly found in Ontario metal mining effluents. All are naturally occurring elements. However, when discharged into the environment in large quantities, they can upset the delicate natural balance that permits the ecosystem to function smoothly.

Establishing the discharge limits

The clean water limits in the regulation are based on the results of a 12-month monitoring program and an examination of the best available technology (BAT) for the sector.

The ministry defines BAT as a combination of demonstrated treatment technologies and industrial process changes that prevent pollution. To determine BAT a consultant was hired to conduct a world-wide search for modern wastewater treatment practices. Mining regulations or guidelines were reviewed from other Canadian provinces, the United States, Europe, Australia and New Zealand. The limits are stated in terms of concentrations, consistent with other metal mining regulations worldwide. These limits can be met with existing technologies.

In anticipation of MISA, many Ontario mining companies have already installed best available technologies. For example, some gold mining companies remove cyanide in effluent by using sulphur dioxide and hydrogen peroxide.

Once the limits are established, the regulated companies are free to choose how they intend to meet the limits. For example, rather than installing end-of-the-pipe treatment, companies may choose to implement pollution prevention controls. A description of the available technology is contained in the report "The Best Available Pollution Control Technology Metal Mining Sector" (June 1992).

The metal mining clean water regulation will result in the application of legally-enforceable limits across the province.

Clean water mining effluent limits for the mining sector

The MISA white paper published in 1986 identified concentration-based units (milligrams per litre) or loading- based units (kilograms per day) as the methods for establishing performance levels.

In metal mining, concentration-based guidelines or control mechanisms are used throughout the world, including other Canadian provinces, the Canadian federal government, the United States, Australia, New Zealand, Spain, Italy, Finland, Sweden, Germany and France.

There are several reasons why environmental agencies throughout the world use concentrations rather than loadings. In general, in the mining sector there is no consistent correlation between flow and production. There is also no consistent correlation between production and effluent loadings. Limits based on concentrations are independent of flow and production and can be used to detect most environmental problems caused by metal mining effluents.

Total loadings of metals from mines tend to be low. At many mines, the individual daily loadings of priority organic substances are only a few grams per day. The metal mining effluent limits regulation will apply to all operating and new mines that discharge more than 50 cubic metres/day (or equivalent to about one twentieth of an olympic-size pool) of wastewater.

The following are the limits proposed for the metal mining sector:

total suspended solids	15.0 mg/litre
lead	0.2 mg/litre
copper	0.3 mg/litre
nickel	0.5 mg/litre
zinc	0.5 mg/litre
arsenic	0.5 mg/litre
total cyanide	1.0 mg/litre
pH	6.0 to 9.5 range
toxicity	undiluted effluent must not kill rainbow trout and water fleas

Comparison to other jurisdictions

Ontario's clean water regulation for metal mining will be among the most stringent in the world. To control mineral industry wastewaters, many jurisdictions rely on various forms of guidelines which generally do not include as many parameters as Ontario's and routinely do not include non-toxic effluent.

Applying the discharge limits

The mining sector regulation will apply to all companies regardless of their sub-sector. There are two approaches to limit discharges from mining operations: in-plant pollution prevention and end-of-pipe treatment.

In-plant controls consist of process modifications, chemical substitution and water reduction and recycling. Improving the efficiency of mine-mill operations through process modifications reduces the amount of pollutants discharged in wastewaters.

In the mining industry, pollution prevention can be achieved by substituting harmful persistent chemicals for less harmful, easier-to-treat chemicals. For example, MIBC (methylisobutylcarbinol), which is not very toxic, has largely replaced pine oil in froth flotation circuits. Pine oil is a source of alpha terpineol which is a compound listed as a priority substance of concern.

In-plant recycling of wastewaters is a common practice of the industry. The recycling of tailings-area effluents and the re-use of minewater is practised to the maximum extent allowed by present technical knowledge.

End-of-the-pipe processes are also available to improve treatment of tailings wastewater and mine wastewater. In gold mines, cyanide is used to separate gold from ore. Substantial treatment is required to recover or destroy the cyanide used in the milling process. In many cases, this means the use of sulphur dioxide or hydrogen peroxide to remove cyanide from effluents.

In addition to limits on specific parameters, mining companies will employ Best Management Practices to reduce or eliminate the contaminants in process effluents or in stormwaters that flow into waterways.

The regulation also incorporates a number of standard monitoring and reporting requirements (in common with clean water regulations being developed for other MISA sectors). Sections of the regulation govern: compliance monitoring, the location of sampling points, sampling and analytical procedures, toxicity testing, the calculation of loadings, effluent flow measurement, quality control, record keeping and reporting to the ministry and the public.

How the regulation was developed

The draft regulation for the metal mining sector was developed through the participation of the mining industry, the Ontario Mining Association, the Ontario Ministry of Environment and Energy, the Ministry of Northern Development and Mines, and federal government representatives in a joint technical committee. A representative of the MISA Advisory Committee of independent environmental experts also attended the joint technical committee meetings. The public will be able to review the draft regulation for a 60-day comment period.

Cost of implementing

Using a ten-year average performance indicator to calculate the potential effects of the regulation on firms, it was determined that costs of implementing the technological changes would be small to negligible in terms of changes in profitability and financial situation.

Penalties for violations

Corporations not complying with the clean water regulation can be subject to a maximum fine of $50,000 per day for a first conviction and $100,000 per day for subsequent convictions.